



# Forests of Western Oregon: *An Overview*

Sally Campbell, Dave Azuma,  
Dale Weyermann



United States  
Department of  
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Cover: Southwest Oregon Photo by Tom Iraci. Above: Oregon Coast Photo by Don Gedney



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U.S. Department of Agriculture Forest Service  
Pacific Northwest Research Station  
Portland, OR  
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## State Forester's Welcome

Dear Reader:

Western Oregon has some of the most productive forest lands in the world, important for sustainable supplies of fish and wildlife habitat, recreation, timber, clean water, and many other values that Oregonians hold dear. The Oregon Department of Forestry and the USDA Forest Service invite you to read this overview of western Oregon forests, which illustrates the importance these forests have to our forest industries and quality of life. This publication has been made possible by the USDA FS Forest Inventory and Analysis (FIA) program, with support from the Oregon Department of Forestry.

The Oregon Department of Forestry and FIA have a long history of collaboration that has benefited both agencies and others who use the data and the information developed from it. This report was developed from data gathered by FIA in western Oregon's forests between 1994 and 1997, and has been supplemented by inventories from Oregon's national forests and the Bureau of Land Management. We greatly appreciate FIA's willingness to collect information in addition to that usually collected in forest inventories, data about insects and disease, young stands, and land use change and development.

Developing current and historical information across all ownerships and forest land types is critical to the Oregon Board of Forestry, which has embarked on an effort to define the concept of forest sustainability and to assess the sustainability of Oregon's forests. These data will be used in monitoring changes in forest conditions, in projecting future forest conditions, and in developing benchmarks against which we can assess Oregon's progress in achieving forest sustainability.

As we move down this path toward ensuring the sustainability of social, economic, and environmental values from forests, it is critical that we develop a consistent knowledge base—common measurements and standards by which to evaluate sustainable forest management locally, statewide, and nationally. This inventory helps develop that knowledge base, and as such, it will be extremely useful in educating Oregonians and others about Oregon's forest resources.

I encourage you to review this material, use it, and if possible, visit Oregon's forests for yourself. We would love to see you here.

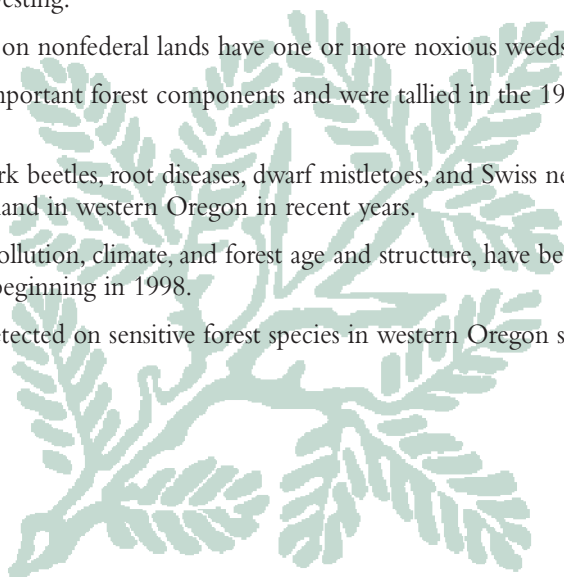
***James E. Brown***

James E. Brown  
State Forester

## Highlights

This publication provides highlights of forest inventories and surveys from 1993 to 2000. It presents both traditional and nontraditional information about western Oregon's forests.

- The amount of forest land in western Oregon has changed little since the earliest inventory in 1930.
- About 80 percent of western Oregon is forested.
- Fifty tree species were tallied in forest inventories during the 1990s, with Douglas-fir the predominant species in all ecological units in western Oregon.
- About 52 percent of western Oregon forest land is managed by the Forest Service, BLM, and other federal agencies; about 41 percent is privately owned; and the remaining 7 percent is managed by the Oregon Department of Forestry and other nonfederal public agencies.
- Average annual growth of trees on nonfederal lands in western Oregon is greater than the average amount of mortality and harvesting.
- One-third of inventory plots on nonfederal lands have one or more noxious weeds.
- Down wood and snags are important forest components and were tallied in the 1993-97 inventories.
- Western spruce budworm, bark beetles, root diseases, dwarf mistletoes, and Swiss needle cast have affected many acres of forest land in western Oregon in recent years.
- Lichens, as indicators of air pollution, climate, and forest age and structure, have been tallied on a portion of inventory plots beginning in 1998.
- No ozone injury has been detected on sensitive forest species in western Oregon since ozone monitoring began in 1998.



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## Abstract

**Campbell, Sally; Azuma, Dave; Weyermann, Dale. 2002. Forests of western Oregon: an overview.**

Gen. Tech. Rep. PNW-GTR-525. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27 p.

This publication provides highlights of forest inventories and surveys from 1993 to 2000. It presents both traditional and nontraditional information about western Oregon's forests. The amount of forest land in western Oregon has changed little since the earliest inventory in 1930. About 80 percent of western Oregon is forested. Fifty tree species were tallied in forest inventories during the 1990s, with Douglas-fir the predominant species in all ecological units in western Oregon. About 52 percent of western Oregon forest land is managed by the Forest Service, BLM, and other federal agencies; about 41 percent is privately owned; and the remaining 7 percent is managed by the Oregon Department of Forestry and other nonfederal public agencies. Growth of trees in western Oregon exceeds the amount removed by harvest and mortality. One-third of inventory plots on nonfederal lands have one or more noxious weeds. Down wood and snags are important forest components and were tallied in these last inventories. Western spruce budworm, bark beetles, root diseases, dwarf mistletoes, and Swiss needle cast have affected many acres of forest land in western Oregon from 1987 to 2000. Lichens, as indicators of air pollution, climate, and forest age and structure, have been tallied on a portion of western Oregon inventory plots beginning in 1998. Monitoring for ozone injury on several sensitive forest species also was begun in 1998; no ozone injury has been detected in western Oregon.



Mount Hood  
Photo by Paul Dunham



## Errata for PNW-GTR-525

The following changes have been made in this document.

**Publication:** *Forests of Western Oregon: An Overview*, PNW-GTR-525, April 2002

**Authors:** Sally Campbell, Dave Azuma, Dale Weyermann

Highlights, 3<sup>rd</sup> page, 5<sup>th</sup> bullet:

Change sentence to read: Average annual growth of trees on nonfederal lands in western Oregon is greater than average annual amount of mortality and harvesting.

Page 1: Corrected footnote 1:

Oregon Natural Heritage Program and Oregon Department of Fish and Wildlife 2000: adapted from Bailey, R.G. 1980 (Ecoregions of the United States. Misc. Publ. 1391. Washington, DC: U.S. Department of Agriculture, Forest Service) and Omernik, J.M. 1987 (Ecoregions of the conterminous United States map [1:7,500,000]. Annals of the Association of American Geographers. 77(1): 118-125).

Page 1: Corrected Source (for map):

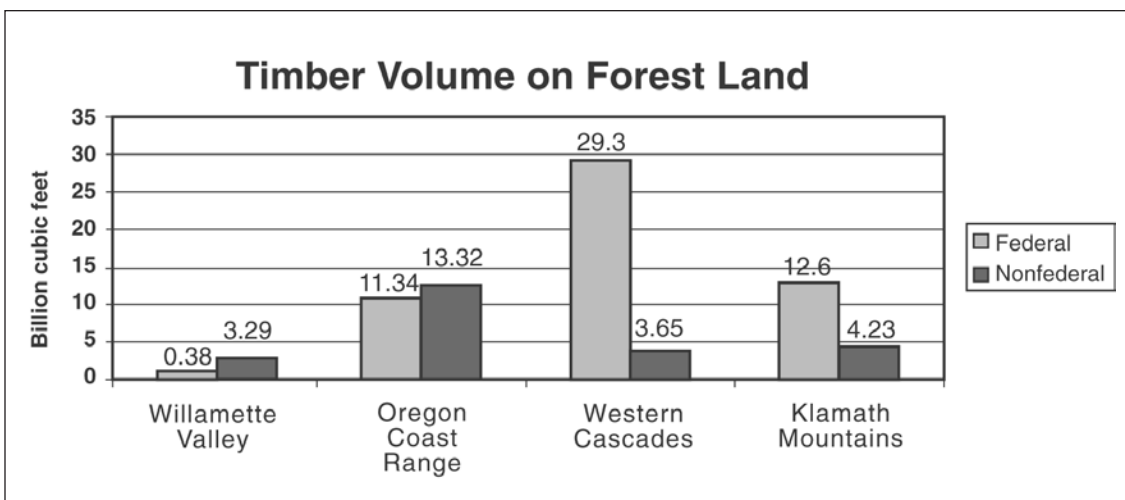
Oregon Natural Heritage Program and Oregon Department of Fish and Wildlife 2000. See footnote 1.

Page 16, first paragraph, 3<sup>rd</sup> sentence: Change the following sentence from:

“The forests of western Oregon have about 75 billion cubic feet of timber...” to:

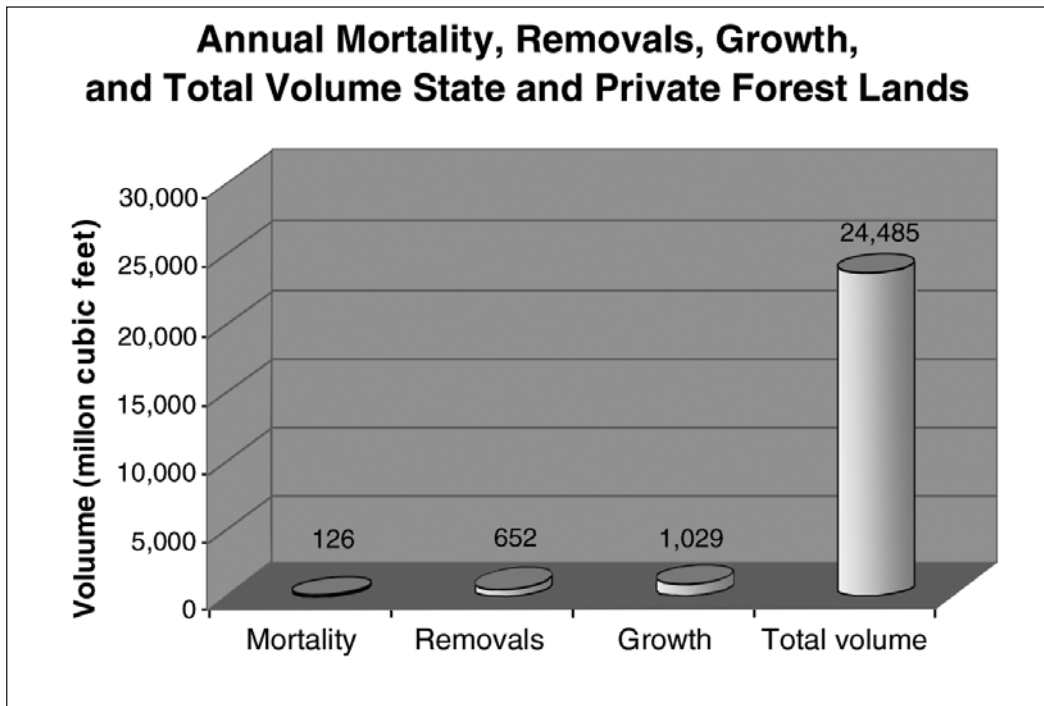
“The forests of western Oregon have about 78 billion cubic feet of timber...”

Page 16: Graph at bottom of page, Timber Volume on Forest Land

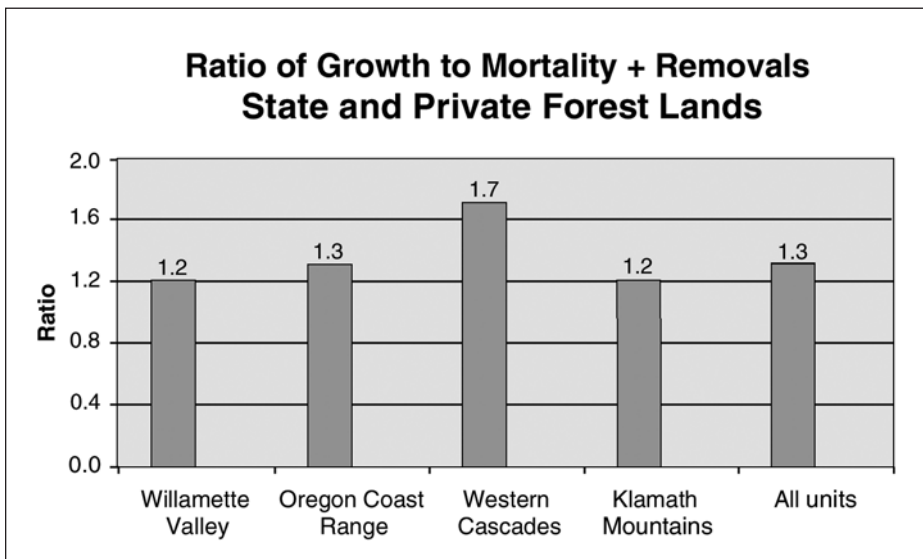




Page 18: Annual Mortality, Removals, Growth, and Total Volume graph



Page 18: Ratio of Growth to Mortality + Removals graph



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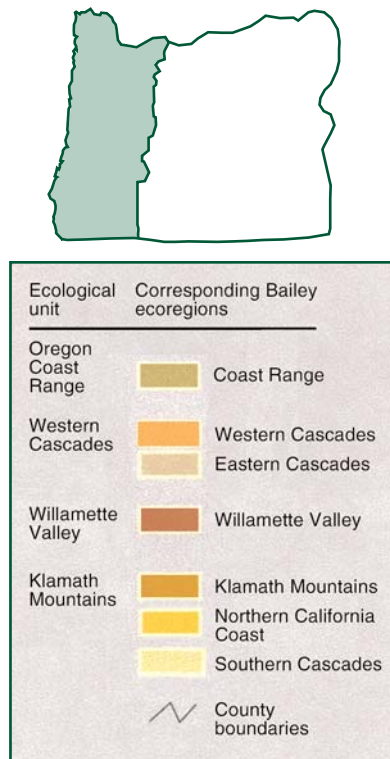
# Introduction

THIS REPORT DESCRIBES THE FORESTS OF WESTERN OREGON TODAY. We present several different aspects of western Oregon forest land: Where it is, how old it is, who owns or manages it, how much wood volume is present, what tree species are present, and where it is being affected by insects, diseases, and air pollutants.

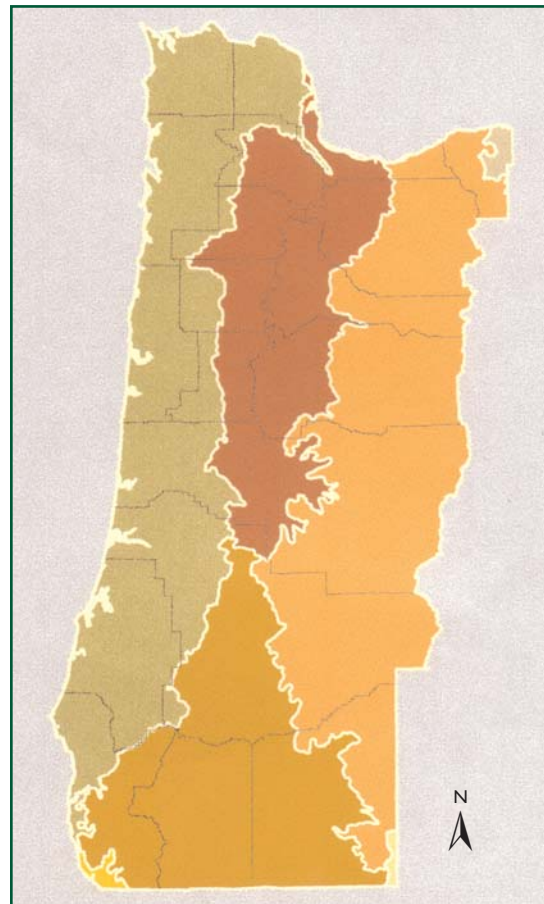
We present the information organized by Bailey's<sup>1</sup> ecological units that delineate relatively homogeneous landscapes by topography, hydrology, and climate. In western Oregon, we use the following ecological units:

- Oregon Coast Range
- Willamette Valley
- Western Cascades
- Klamath Mountains

<sup>1</sup> Oregon Natural Heritage Program and Oregon Department of Fish and Wildlife 2000; adapted from Bailey, R.G. 1980 (Ecoregions of the United States. Misc. Publ. 1391. Washington, DC: U.S. Department of Agriculture, Forest Service) and Omernik, J.M. 1987 (Ecoregions of the conterminous United States map [1:7,500,000]. Annals of the Association of American Geographers. 77(1): 118-125.



**Ecological units of western Oregon**



Source: Oregon Natural Heritage Program and Oregon Department of Fish and Wildlife 2000. See footnote 1.



Inventory field crew gathering data. Photo by Tom Iraci

Most of the information in this report is from three sources: the 1994–97 USDA Forest Service Forest Inventory and Analysis (FIA) inventory on state and private lands, the 1993–96 inventory on national forests, and the 1997 inventory on USDI Bureau of Land Management (BLM) lands. We also include information from the 1997–2000 forest health monitoring plots (now part of the FIA plot network), and from forest insect and disease aerial surveys between 1987 and 2000. With the exception of the aerial surveys where forest condition is observed and recorded from the air, all other data are collected by field crews visiting permanent ground plots.

Two terms are commonly used to describe forested land – “forest land” and “timberland.”

- **Forest land** (15.3 million acres in 1997 in western Oregon) is a more encompassing term that includes all land that is at least 10 percent covered by trees of any size, greater than 1 acre in area, and at least 120 feet wide.
- **Timberland** (13.8 million acres in 1997 in western Oregon) is a portion of the forest land (described above) that produces (or is capable of producing) more than 20 cubic feet per acre of industrial wood products each year under natural conditions, is not withdrawn from timber use, and is not developed for nonforest uses.

Areas included in forest land but excluded from timberland are national and state parks, nature preserves, wilderness areas, and urban forests (such as cemeteries and city parks). Also, because of agency policies such as the Northwest Forest Plan and riparian reserves, all federal lands meeting the above definition of timberland may not be equally available for timber production.



# What is the History of Western Oregon Forests?

**F**OR CENTURIES BEFORE EUROPEAN SETTLEMENT of the Pacific Northwest, the primary agents of forest change were fire, wind, volcanic activity, insects, and disease. To a much lesser extent, native people also modified the vegetation of western Oregon—both accidentally and deliberately. In prairie areas (such as the Willamette Valley) and adjacent dry Douglas-fir forests, they set fires for herding and to promote growth of berries, roots, and other native crops. Small settlements along rivers, bays, and estuaries altered local topography, vegetation, and wildlife.<sup>2</sup>

In the mid-1800s, Euro-Americans began to settle in western Oregon. They lit fires to clear land for grazing, agriculture, and town sites. They altered riparian areas by trapping and virtually eliminating beavers. In the more forested areas of the Coast Range, western Cascades, and the Klamath Mountains, extensive timber harvest, grazing and ranching, mining, and dam construction significantly altered the forests of western Oregon. Fires were used to remove slash after logging; some of these fires escaped and resulted in large forest fires.<sup>3</sup>

<sup>2</sup> McNab, H.W.; Avers, P.E., comps. 1994. Ecological subregions of the United States: section descriptions. Washington, DC: U.S. Department of Agriculture, Forest Service.

<sup>3</sup> Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Washington, DC: Island Press. 493 p.



The Tillamook Burn was one of the largest forest fires in western Oregon's history. *Oregon Historical Society Photo*

## Significant forestry events in western Oregon

**1829:** Oregon City lumber mill—one of Oregon's first sawmills, established by Dr. John McLoughlin on the Willamette River. By 1870, there were 173 sawmills in Oregon. In 1885, the first Northwest paper mill was built on the Columbia River at Camas, Washington.

**1905:** The USDA Forest Service is created—the purpose of this new federal agency was to conserve forest resources and stabilize markets.

**1930:** First forest inventory in western Oregon—mandated by McSweeney-McNary Act of 1928.

**1933:** Tillamook Burn—a lightning-caused fire that burned 239,695 acres in the Oregon Coast Range.

**1962:** Columbus Day Storm—the strongest windstorm of the 20<sup>th</sup> century on the west coast that blew down more than 6.2 billion board feet of timber in forests in western Oregon.

**1964:** The Wilderness Act—this act originally designated 9.1 million acres of wilderness on national forest land across the United States. Now nearly 100 million acres of wilderness, countrywide, is

*Continues on page 4.*



Logging in western Oregon in the early 1900s. *USDA FS Photo*

Logging in the Pacific Northwest created many changes in forest vegetation. Forest industry gained momentum in the late 1800s and into the 1900s with railroads, steam and gas engines, new logging technology, and demand created by the increasing and more prosperous population. By the 1950s, the most productive western Oregon forests were being managed to maximize timber production. When cutover sites were replanted, Douglas-fir was usually the only species planted.

managed by the Forest Service, BLM, and Fish and Wildlife Service. Oregon currently has 40 wilderness areas, 28 of these falling partially or wholly in western Oregon and covering nearly 1 million acres.

**1970:** The National Environmental Policy Act—a law requiring analysis of environmental and economic impacts of significant actions (such as timber harvest) on federal lands.

**1971:** Oregon State Forest Practices Act—the nation's first forest practices act setting minimum standards for state and private forest lands for reforestation, road construction and maintenance, timber harvesting, chemical application, and slash disposal. Federal forest managers agreed to meet or exceed these standards.

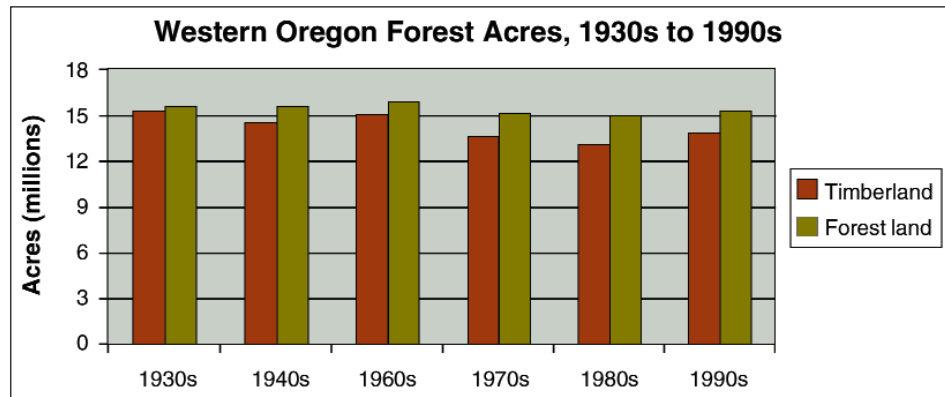
**1973:** Endangered Species Act—an act requiring federal departments and agencies to conserve endangered and threatened species and their habitat.

**1973:** Oregon Land Conservation and Development Act—a land use planning law to limit further loss of Oregon's most productive forest and farm land.

**1976:** The National Forest Management Act—requires the Forest Service to prepare management plans for each national forest to provide for multiple use and sustained yield. Federal Lands Policy and Management Act in the same year authorized BLM to inventory and manage its public land for similar purposes.

**1993:** Northwest Forest Plan—a plan proposed by President Clinton to provide for a sustainable forest environment and economy in western Oregon, western Washington, and northern California. About 8 million federal acres are affected by the plan in western Oregon.

Forest inventories by the Forest Service were authorized in 1928 by the McSweeney-McNary Forest Research Act. The first inventory in western Oregon was undertaken in 1930. Inventories from that first one to the present show a relatively stable amount of forest land (although many of the actual acres have changed from one status to another in both directions). Timberland acres have decreased somewhat, although some of this has been offset by the addition of abandoned Christmas tree plantations and natural reforestation of pasture land.



#### Today<sup>4</sup>

- Almost 90 percent of nonfederal and 95 percent of federal land in western Oregon remains in forest and agricultural uses.
- Oregon land use laws seek to preserve farm and forest lands while designating limited areas for urban expansion.
- Between 1973 and 1982, 247,000 acres of forest and farm land were converted to low-density residential and urban uses.
- Between 1982 and 1994, after land use plans were in place and with a slower economy, rate of conversion declined from 27,000 to 6,000 acres per year.
- More than 80 percent of the shifts in land use in western Oregon from the 1970s to the 1990s were from agriculture or wildland forest to low-density residential or urban areas.
- The most significant shifts from forest or farm uses to more developed uses occurred on private land in the Willamette Valley.

<sup>4</sup> Azuma, D.L.; Birch, K.R.; DelZotto, P. [and others]. 1999. Land use change on nonfederal land in western Oregon, 1973-1994. Salem, OR: Oregon Departments of Forestry, Land Conservation and Development, and Agriculture; U.S. Department of Agriculture, Forest Service. 55 p.

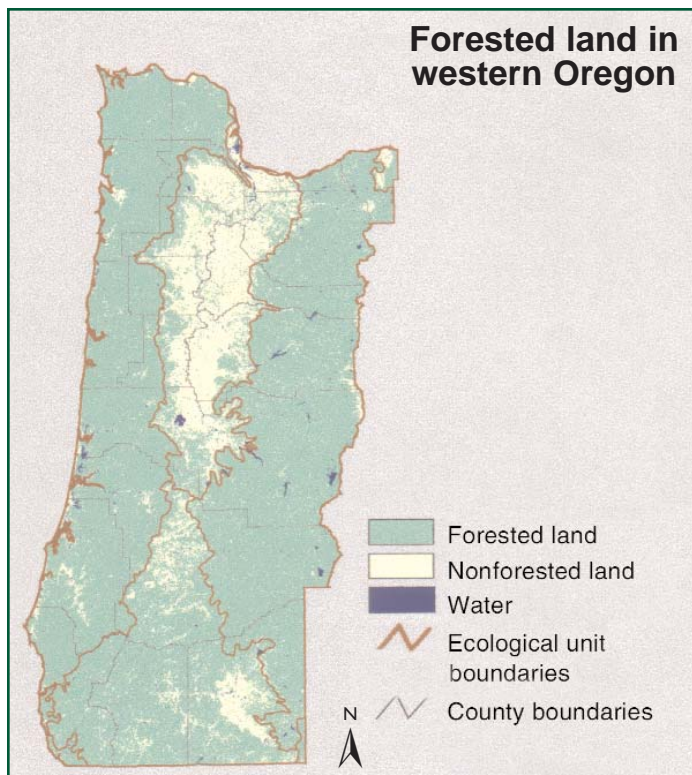
# How Much of Western Oregon Is Forest and Where Is It?

A LARGE PART OF WESTERN OREGON—about 80 percent—is forested. Of western Oregon’s 19.2 million acres, 15.3 million are forested. Only the larger river valleys (Willamette, Rogue, and Umpqua Valleys), where most of the population of Oregon lives and much of the state’s farming and industry occurs, are sparsely forested.

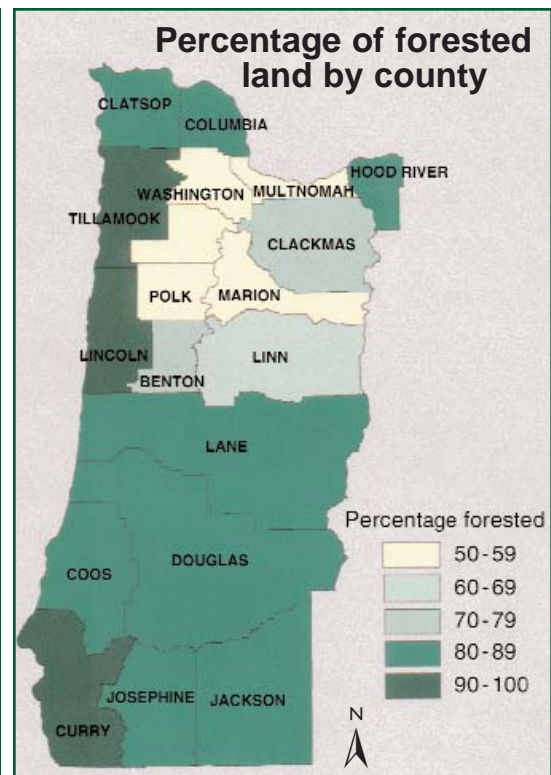
The Oregon Coast Range unit comprises about 30 percent of western Oregon. It has the highest percentage of forest land in the state. Because of the marine influence, it has the warmest winters, coolest summers, and greatest



Oregon Coast Range. Photo by Don Gedney



Source: Multiresolution Land Characterization Consortium (MRLC), U.S. Geological Survey. Map produced by classification of Landsat 5 satellite imagery (acquired 1992).



Source: Forest Inventory and Analysis data, 1996 forest inventory of western Oregon (unpublished), USDA Forest Service, PNW Research Station, Portland, OR.





Willamette Valley. Photo by Don Gedney



Western Cascades. Photo by Don Gedney

rainfall in Oregon. Many small- to medium-sized towns, such as Tillamook, Newport, Coos Bay, and Bandon are along the Pacific coast.

The Willamette Valley unit, nestled between the Coast Range and the western slopes of the Cascade Range, comprises about 18 percent of western Oregon, has the lowest percentage of forest land, and the highest number and concentration of people. Most of the land in the valley lies between 50 and 1,000 feet in elevation. Forests



Klamath Mountains. Photo by Tom Iraci

are found primarily in the foothills of the Coast Range to the west and the Cascade Range to the east. Summers are hot and dry, with periodic summer droughts. This unit includes the Portland, Salem, and Eugene metropolitan areas.

The Western Cascades unit, extending north to south on the western flank of the Cascade mountain range, makes up 32 percent of western Oregon. It has the second highest percentage of forest land in the state. Wide ranges in elevation (near sea level to over 11,000 feet) and precipitation (50 to 150 inches) are typical of this unit.

The Klamath Mountains unit makes up about 20 percent of western Oregon. It is almost 80 percent forest land. It is the most vegetatively diverse unit in western Oregon and one of the most diverse in the United States. The climate is mediterranean with generally mild, wet winters and warm, dry summers. Towns in this area include Medford and Roseburg.

Ecological unit	Forest land <sup>a</sup>	Nonforest land <sup>a</sup>
	----- Percent -----	
Oregon Coast Range	94	6
Willamette Valley	35	65
Western Cascades	93	7
Klamath Mountains	79	21

<sup>a</sup> Based on plot data.

# What Trees Grow in Western Oregon?

**M**ANY SPECIES OF TREES GROW IN WESTERN OREGON. Forest inventories measure trees on each inventory plot and record detailed information on live trees including species, age, diameter, height, and damage by insects and disease.

Some trees, such as Douglas-fir, grow in a wide range of environmental conditions and are found in every ecological unit in western Oregon. Others have more specific growing requirements and may be found in only one area, such as Port-Orford-cedar found only in the western portion of the Klamath Mountains unit. Fifty species of trees were tallied in western Oregon inventories: 20 hardwood species and 30 conifer species. Collections of species in an area make up a forest type, which, in western Oregon, is named after the predominant species.

## **Oregon Coast Range**

Douglas-fir is the predominant species, and therefore forest type, in the Oregon Coast unit. Other common tree species in this area include western hemlock, red alder, bigleaf maple, and western redcedar. Lodgepole pine (or “shore pine”) and Sitka spruce occur along the coast.



Douglas-fir is the most common tree species in western Oregon. *Photo by Tom Iraci*

Forest type	Thousand acres	Percent
Douglas-fir	3,200.6	67.1
Red alder	707.5	14.8
Hemlocks ( <i>Tsuga</i> spp.)	424.3	8.9
Sitka spruce	139.6	2.9
Bigleaf maple	48.0	1.0
Oregon white oak	46.4	1.0
Pines ( <i>Pinus</i> spp.)	40.4	.8
Pacific madrone	31.8	.7
True firs ( <i>Abies</i> spp.)	28.2	.6
Western redcedar	22.6	.5
Others	78.9	1.7
Totals	4,768.3	100.0



Sitka spruce. Photo by Tom Iraci

### Western Cascades

Douglas-fir is the predominant species and forest type in the Western Cascades unit. Other species such as western hemlock, western redcedar, white fir, and grand fir are common at lower elevations, with Pacific silver fir, mountain hemlock, lodgepole pine, and subalpine fir found at higher elevations.

Forest type	Thousand acres	Percent
Douglas-fir	2,857.2	60.0
Hemlocks ( <i>Tsuga</i> spp.)	817.2	17.2
True firs ( <i>Abies</i> spp.)	713.5	15.0
Pines ( <i>Pinus</i> spp.)	109.2	2.3
Red alder	79.1	1.7
Western redcedar	47.5	1.0
Bigleaf maple	30.0	.6
Oregon white oak	14.3	.3
Others	96.8	2.0
Totals	4,764.8	100.0



Mountain hemlock. Photo by Don Gedney

### Willamette Valley

Douglas-fir is the predominant species and forest type in the Willamette Valley. In addition to Douglas-fir, common species include red alder, Oregon white oak, bigleaf maple, and western hemlock. Some unique native populations of ponderosa pine (“valley pine”) and grand fir also can be found in the Willamette Valley, although many of these are dwindling owing to urbanization, river channelization, and insect infestations.

Forest type	Thousand acres	Percent
Douglas-fir	721.5	64.9
Red alder	97.0	8.7
Oregon white oak	94.9	8.5
Bigleaf maple	94.8	8.5
Western redcedar	20.9	1.9
Western hemlock	19.5	1.8
Oregon ash	14.7	1.3
Black cottonwood	13.8	1.2
Grand fir	9.8	0.9
Others	24.4	2.2
Totals	1,111.3	100.0



Oregon white oak. Photo by Paul Dunham



## Klamath Mountains

The Klamath Mountains unit is the most vegetatively diverse in western Oregon—encompassing climatic, geomorphic, and vegetative elements from California, the northwest coast of Oregon, and eastern Oregon. Douglas-fir is the dominant species and forest type in this area. Other common species include dry-site hardwoods such as tanoak, canyon live oak, Oregon white oak, Pacific madrone, golden chinkapin, California laurel, and California black oak. Common conifers include western hemlock, incense cedar, white fir, western redcedar, western white pine, Port-Orford-cedar, ponderosa pine, and sugar pine.

Forest type	Thousand acres	Percent
Douglas-fir	1,981.8	28.5
Tanoak	1,384.4	19.9
Oaks ( <i>Quercus</i> spp.)	1,113.4	16.0
True firs ( <i>Abies</i> spp.)	364.4	5.2
Hemlocks ( <i>Tsuga</i> spp.)	335.0	4.8
Pacific madrone	321.2	4.6
Incense cedar	295.1	4.2
Pines ( <i>Pinus</i> spp.)	281.2	4.0
Golden chinkapin	251.2	3.6
California laurel	180.1	2.6
Western redcedar	123.2	1.8
Port-Orford-cedar	86.3	1.2
Red alder	56.3	0.8
Bigleaf maple	41.0	0.6
Others	143.0	2.1
Totals	6,957.6	100.0

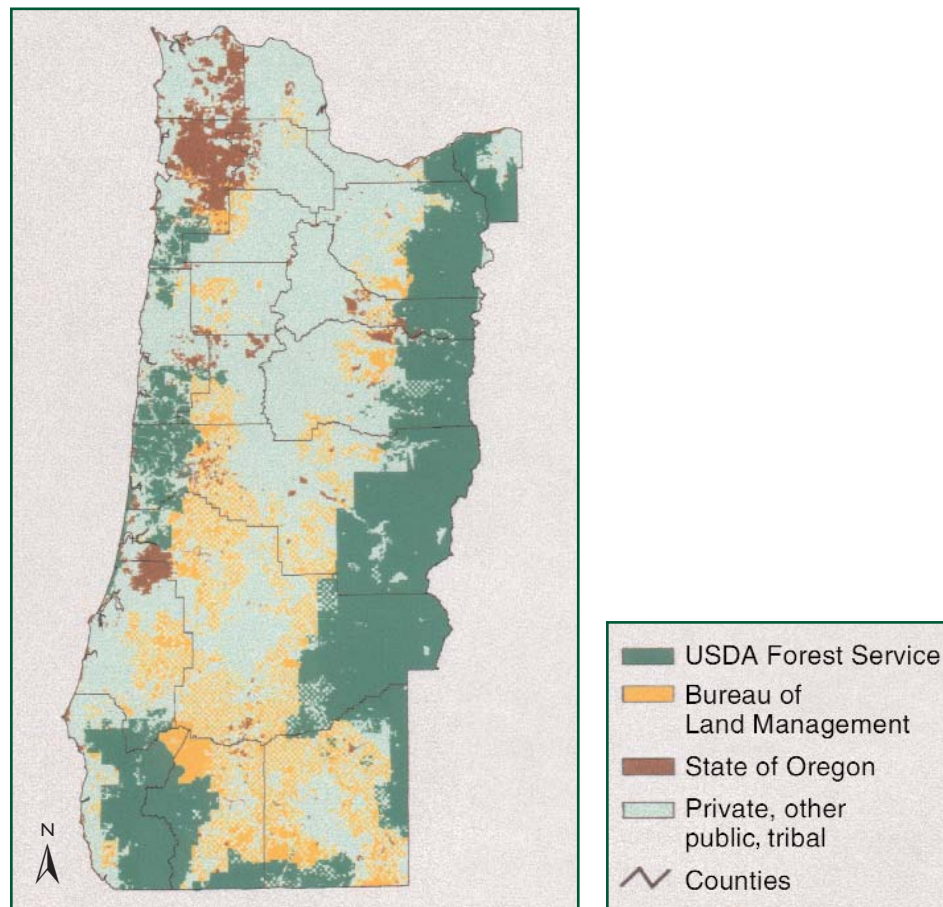


Pacific madrone. Photo by Don Gedney

# Who Owns Western Oregon's Forests?

THE FOREST SERVICE, BUREAU OF LAND MANAGEMENT AND OTHER FEDERAL AGENCIES manage about 52 percent of forest land in western Oregon; industrial and nonindustrial private landowners own about 41 percent; and the state of Oregon and other nonfederal public entities manage the remaining 7 percent. Public forest land is owned by the public and managed by agencies such as the USDA Forest Service, USDI Bureau of Land Management, Oregon Department of Forestry, counties, and municipalities. Most of the public forest land in western Oregon is national forest—over 5.6 million acres of forest land is found on the Mount Hood, Rogue River, Siskiyou, Siuslaw, Umpqua, and Willamette National Forests. Bureau of Land Management forest land includes 2.3 million acres primarily in the Coast Range and Klamath Mountains. State and other nonfederal public forest

## Land ownership in western Oregon



Source: Ownership of western Oregon, Oregon Department of Forestry, Salem, OR.



National Forests in western Oregon manage over 5.6 million acres of forest land. Photo by Don Gedney



Forestry companies own over 6.3 million acres in western Oregon. Photo by Don Gedney

land, about 1 million acres, is also primarily in the Coast Range. Management of public forests is guided by management plans, and each plan typically allows for a multitude of uses across the landscape, from providing recreation to harvesting timber to preserving wildlife to maintaining municipal watersheds. Plans are updated periodically with public review.

A 1994 survey of private forest landowners showed that about 124,000 individuals or companies owned over 6.3 million acres in western Oregon.<sup>5</sup> Private landowners own forest land for many different reasons. This makes it difficult to explain and predict how landowners will manage their forest resources. When private owners in western Oregon were asked in 1994 why they owned forest land, most owned it because it was part of their residence or because they bought it as an investment or for visual enjoyment. However, over 75 percent of the acres (owned by only 5 percent of owners) were used for timber production. Many of the private forest landowners, especially industrial owners, have management plans for their forests.

Primary benefit expected by private forest landowners in the next 10 years in western Oregon:

Benefit	Number of owners	No. acres	Avg. acres per owner
Land value increase	35,000	356,000	10.2
Farm and domestic use	33,000	279,000	8.5
Aesthetic enjoyment	30,000	490,000	16.3
Other	8,000	123,000	15.4
Income from timber	6,000	4,873,000	812.2
Recreation	2,000	110,000	55.0
Firewood	1,000	27,000	27.0

Sources: Birch, T.W. 1997. Private forest-land owners of the western United States, 1994. Resour. Bull. NE-137. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 249 p. Butler 2001 (see footnote 5).

<sup>5</sup> Butler, B.J. 2001. Extraction of data for western Oregon from 1994 survey database. National Woodland Owner Survey Coordinator. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station.



# How Old Are Trees in Western Oregon?

**F**OREST AGE DEPENDS ON THE TIME SINCE THE LAST harvest; the frequency, extent, and severity of disturbances such as forest fires or insect outbreaks; and, if left undisturbed, the lifespan of different species. Some tree species, such as cottonwood with average life-spans of 60 to 90 years, are relatively shortlived. Others, such as Douglas-fir and Sitka spruce, can live for several hundred years.

Disturbances that cause mortality (fire, disease, insect attack, wind storms, flooding, etc.) result in mosaics of tree ages as regeneration fills in the gaps created by dead trees. The pattern of mortality, and thus ages, can differ from large continuous areas to small patches to single trees scattered throughout the forest.



Older Douglas-fir. Photo by Tom Iraci

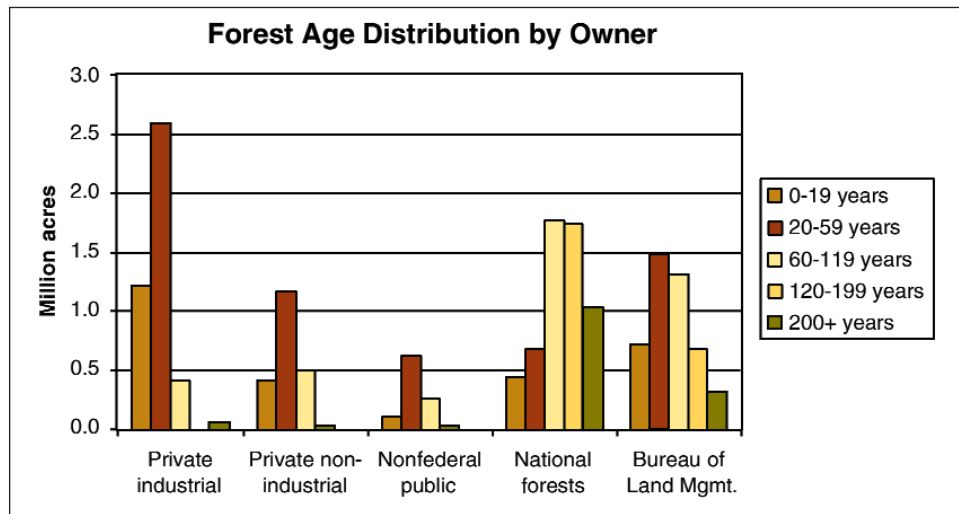


Several age cohorts of Douglas-fir in the Oregon Coast Range. Photo by Don Gedney



Recently planted Douglas-fir seedling. Photo by Tom Iraci



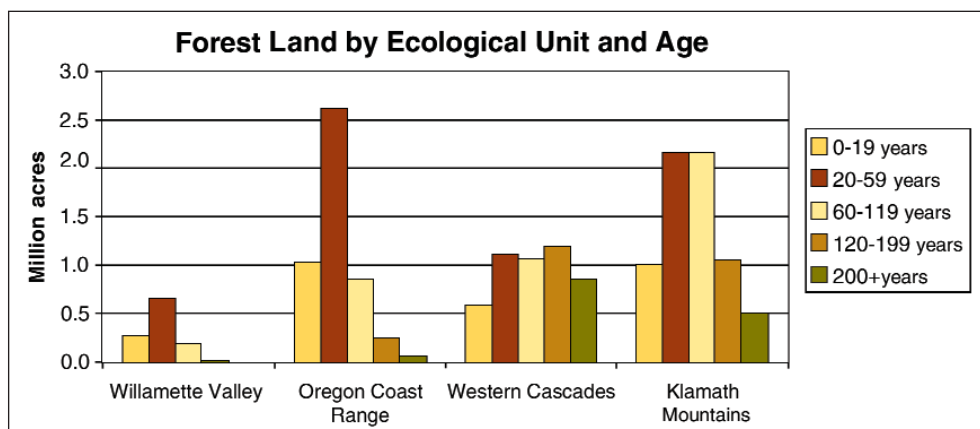


There are many areas in western Oregon where trees have never been harvested—mainly on public lands in reserved areas such as wildernesses in national forests and at higher elevations. Most of the reserved lands are in the Western Cascades and Klamath Mountains units and are federally owned. About 17 percent of the acres in these reserve areas have forests older than 200 years.

The majority (about 78 percent) of western Oregon’s forests are under 120 years old. National forest lands have more acres with older trees (over 60 years old) than other lands where most acres have trees under 60 years old.

Distribution of tree ages varies by ecological unit and most likely is related mainly to past disturbances (primarily large fires), ownership, and management activities:

- The Coast Range and Willamette Valley units have relatively younger forests, with the majority of acres between 1 and 60 years old. Less than one percent of the acres have forests greater than 120 years old.
- The Western Cascades unit has a fairly even number of acres in each age class. It has the highest number and percentage of acres with forests over 200 years old—about 850,000 acres and 18 percent, respectively.
- The Klamath Mountains unit has the majority of acres (62 percent) with forests between 20 and 120 years old. About 7 percent of the acres have forests greater than 200 years old.



# What Is the Volume of Wood in Western Oregon?

**T**IMBER REMAINS AN ESSENTIAL part of western Oregon's economy.

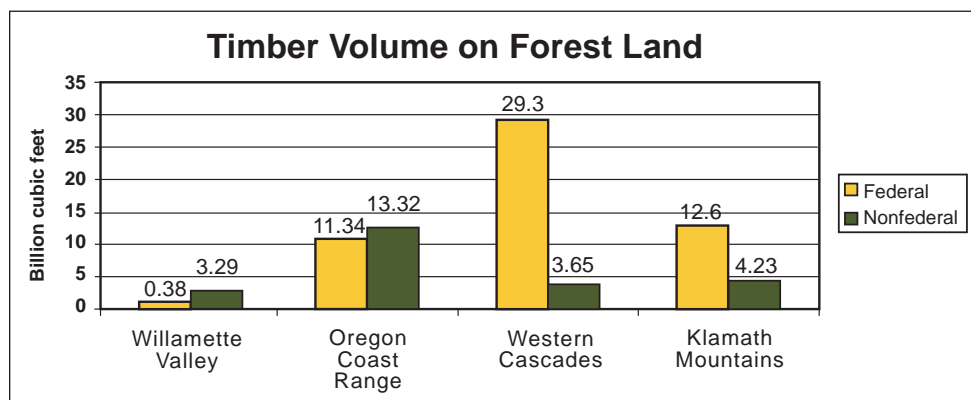
Many products such as paper, lumber, particle board, firewood, and oak barrels are produced from the timber in western Oregon's forests. The forests of western Oregon have about 78 billion cubic feet of timber (1 cubic foot = 1 foot high by 1 foot wide by 1 foot deep). This volume would classify western Oregon as one of the top timber regions of the country.



Western Oregon's forests produced over 9 billion cubic feet of wood from 1985 to 1997. Photo by Tom Iraci

The ownership of this timber is a key factor in determining the availability of the timber for commercial use. About 71 percent of this volume is in federal ownership, mainly BLM and Forest Service, and is not necessarily available for production of forest products. The average volume produced from federal timberlands between 1995 and 1997 is about 30 percent of what the average production was in the decade of the 1980s. Federal lands have reduced production for various reasons including riparian and wildlife reserves and withdrawal of limited access areas. Some state lands also may be withdrawn in the near future depending on present studies.

The volume differences between federal and nonfederal lands are most pronounced in the western Cascades and Klamath Mountains where federal lands have 90 and 76 percent of the volume, respectively. In the Willamette Valley, nonfederal owners own about 88 percent of the volume.



# How Fast Are Trees Growing, Dying, and Being Removed in Western Oregon?



Growth of forests is estimated from tree measurements. Photo by Tom Iraci

**B**ETWEEN THE 1980s AND 1990s, TREES ON STATE AND PRIVATE TIMBERLANDS IN WESTERN Oregon grew faster than they died or were cut. Current change data was not available for federal timberlands.

“Growth” is the annual average growth of live trees that can be measured for volume. “Removal” is the annual average volume removed by harvesting, silvicultural activities (such as thinning), and land clearing. “Mortality” (death) is the annual average volume of trees that died of natural causes. Natural causes include competition, insect attack, disease, fire, drought, or other environmental factors.

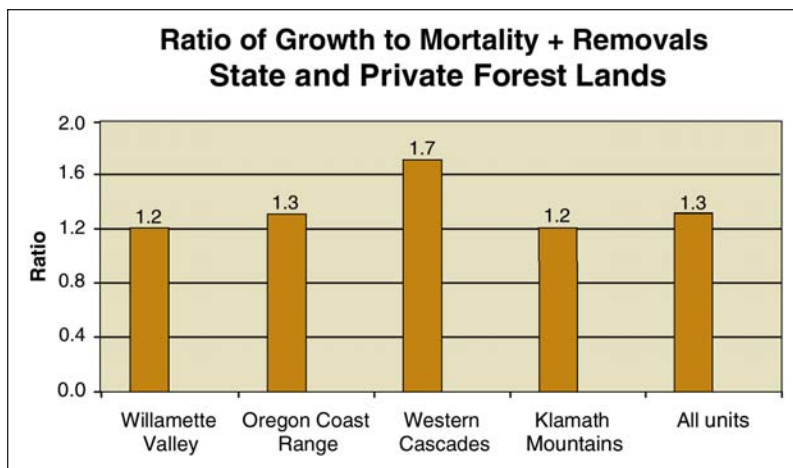
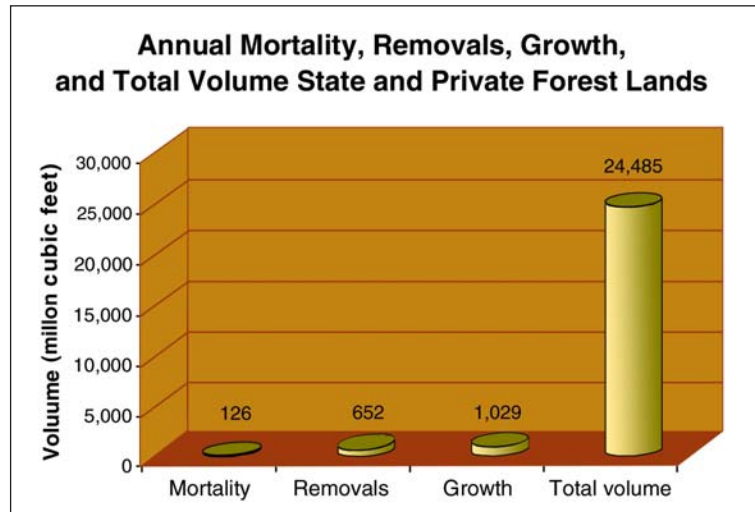
Comparing tree growth to mortality plus removals from the 1980s to the 1990s illustrates one aspect of forest sustainability. The ratio of annual growth to mortality plus removals exceeded 1.0 for all ecological units, indicating that the volume of wood is increasing on nonfederal timberlands in western Oregon. The ratio was highest in the Western Cascades and Klamath Mountains units and lowest in the Willamette Valley and Coast Range units.



Harvesting in the Oregon Coast Range. Photo by Don Gedney



Mortality caused by western spruce budworm in the late 1980s. Photo by Tom Iraci





# How Much Dead Wood Is in Western Oregon Forests?



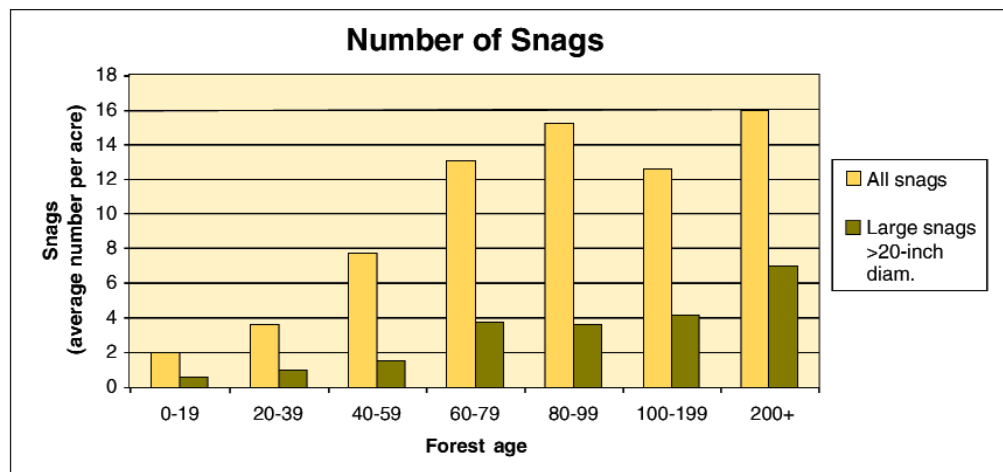
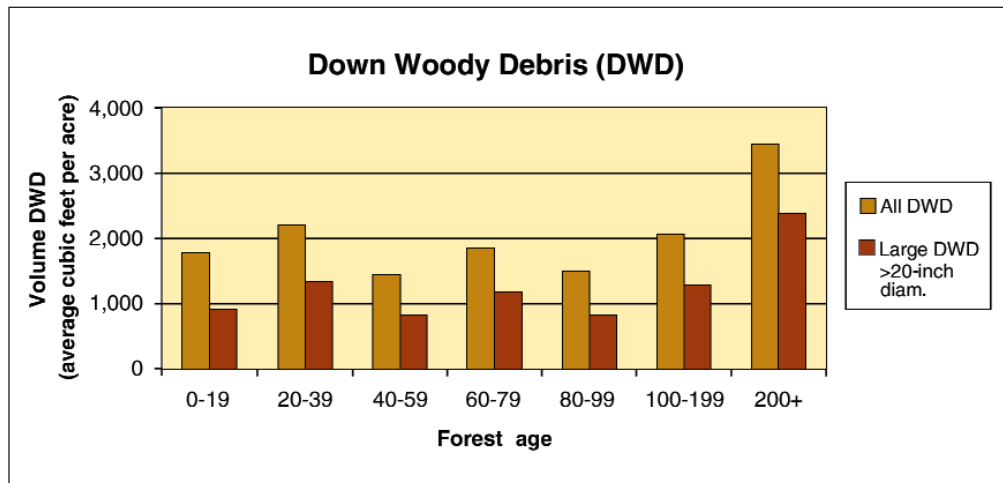
Snags and down woody debris. Photo by Tom Iraci.

**D**EAD WOOD IS AN ESSENTIAL PART OF THE FOREST. When trees die from natural causes, they often remain standing for a period of time—these standing dead trees are called “snags.” All dead trees eventually fall to the ground, becoming “down wood.” When trees are harvested, portions of the tree may be left behind—branches or unusable sections of the trunk. Dead wood, whether standing or down, plays key roles in forest ecosystems: it stores carbon; releases nutrients as it decays; provides substrate, habitat, and food for a wide array of other plants and animals; holds moisture; and serves as fuel for wildfire.

In western Oregon forests, the amount of dead wood varies tremendously across space and time. It is affected by forest age and type, site productivity, ownership (and therefore management activities), geographic and topographic location, and by the amount of insect, disease, and other mortality-causing events including fires and windstorms.



Down woody debris includes decaying logs. *Photo by Don Gedney*

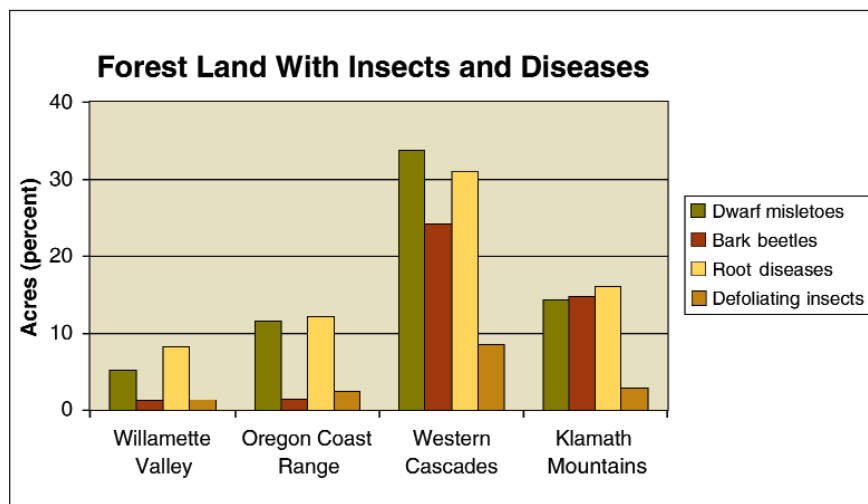


# What Insects and Diseases Are in Western Oregon Forests?

**N**ATIVE INSECTS AND DISEASES PLAY AN IMPORTANT ROLE IN WESTERN OREGON forests—both beneficial and detrimental, depending on your point of view. They contribute to ecosystem functioning and diversity by creating dead material for nutrient recycling, create openings that result in mosaics of species and ages, and provide habitat for wildlife. The mortality and growth loss they cause also can reduce productivity of forests being managed for wood production and increase risk of wildfire.

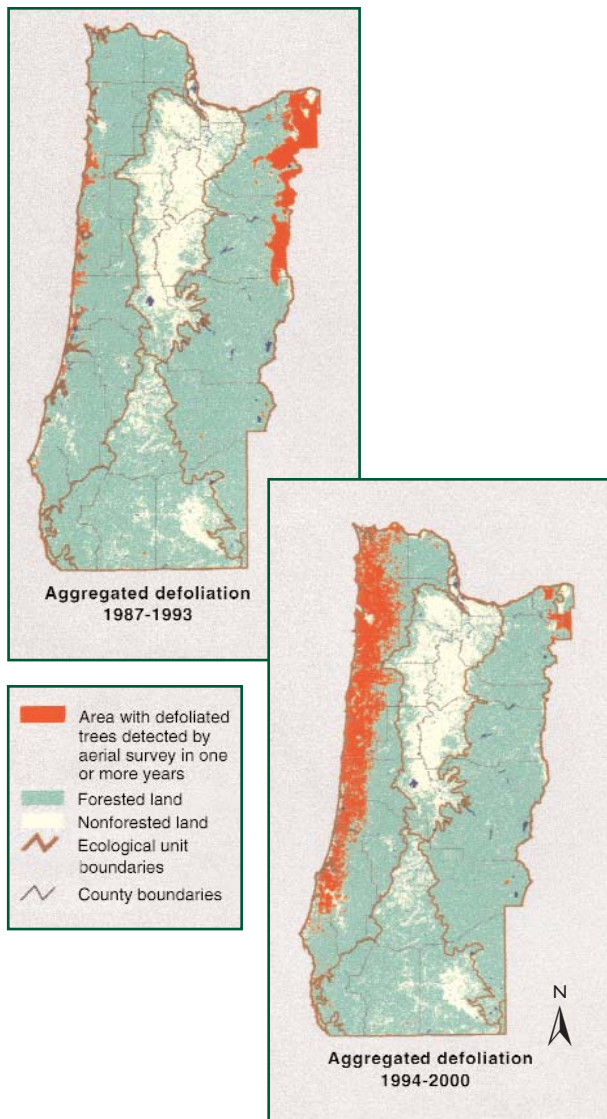
The Western Cascades unit had a higher percentage of acres that contained dwarf mistletoes, root diseases, bark beetles, and insect defoliators than other ecological units in western Oregon. Dwarf mistletoes and root diseases were more commonly recorded than bark beetle damage or insect defoliation.

Annual aerial surveys by Forest Service and Oregon Department of Forestry insect and disease staff are conducted to detect and map forest defoliation and mortality that is often missed during plot visits owing to the localized nature of some diseases and insects, their spotty distribution, or the short period of time over which damage is visible. Any area with visible defoliation is mapped, and, with a few exceptions, any area with more than 5 dead trees is mapped. Trends in defoliation and mortality mapped from the air are shown below for the past 13 years.

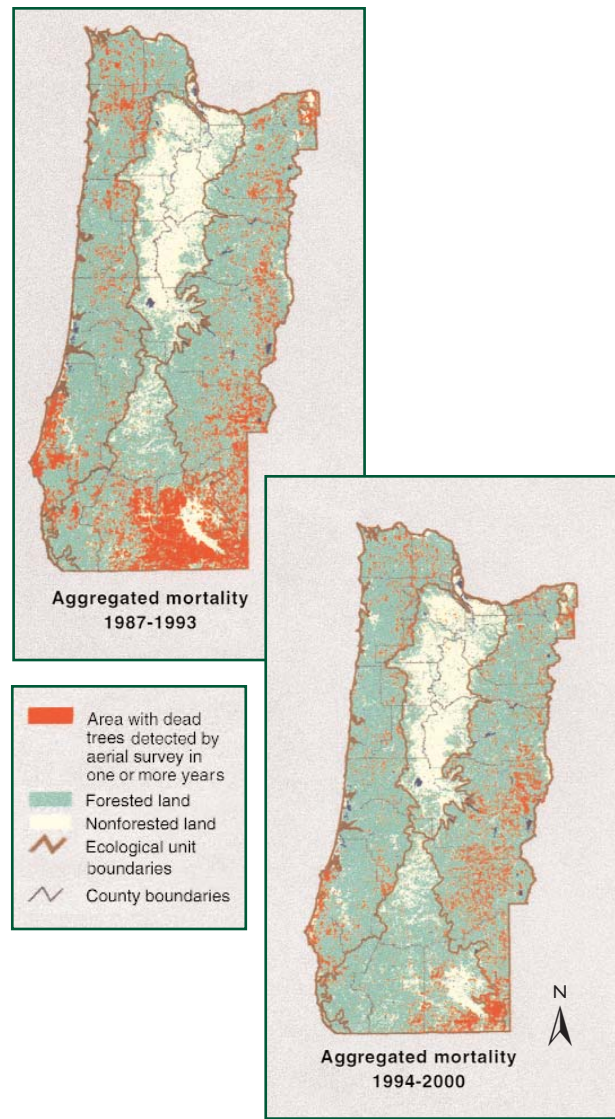


Douglas-fir needles infected with Swiss needle cast fungus. Photo by Alan Kanaskie

## Forest defoliation in western Oregon



## Forest mortality in western Oregon



Source: Forest Insect and Disease aerial survey data, USDA Forest Service PNW Region, Portland, OR and Oregon Department of Forestry Salem, OR.

**Western spruce budworm** (*Choristoneura occidentalis* Freeman) defoliated Douglas-fir and true fir over huge areas of eastern Oregon and the northern portion of the western slope of the Cascade Range in the late 1980s and early 1990s. **Swiss needle cast** (*Phaeocryptopus gaeumannii* (Rohde) Petrak.), a foliar pathogen, has caused significant defoliation and growth loss of Douglas-fir along the Oregon coast in the last 6 years and accounts for most of the defoliation seen in coastal forests in those years. Drought in the late 1980s and early 1990s, coupled with overstocked stands, contributed to higher levels of mortality of pines, Douglas-fir, and true firs, primarily from **bark beetles** during those years. More recently, several consecutive years—beginning in 1996—of storm-caused windthrow resulted in an outbreak of **Douglas-fir beetle** (*Dendroctonus pseudotsugae* Hopk.) from 1998 to the present.



# What Noxious Weeds

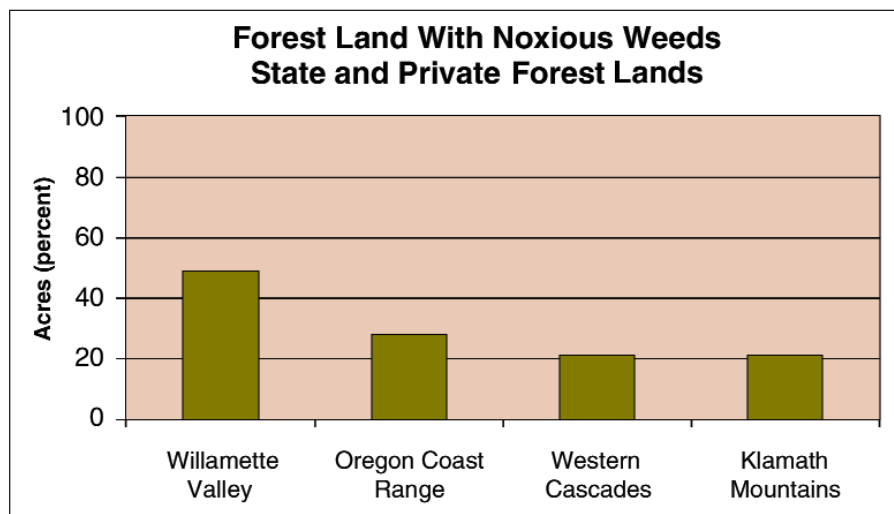
## Are Most Common and Where Are They in Western Oregon Forests?

NOXIOUS WEEDS ARE PLANTS THAT ARE INJURIOUS to public health, agriculture, recreation, wildlife, or public or private property.<sup>6</sup> Most are introduced from other parts of the United States or other countries. Noxious weeds in forests compete with native vegetation, reduce usable wildlife habitat, and can result in increased fire risk. Thirty percent of nonfederal forested acres in western Oregon had at least one noxious weed in the 1994–97 FIA inventory. Plant species (including noxious weeds) are only tallied if they cover more than 3 percent of the plot. The most prevalent noxious weed was Himalayan blackberry (*Rubus discolor* Weihe & Nees), occurring on 53 percent of the acres where at least one noxious weed was recorded. Other common species were thistle (*Cirsium* spp.), and Scot's broom (*Cytisus scoparius* L.). The Willamette Valley had the highest percentage of acres with noxious weeds—50 percent—and the Western Cascades and Klamath Mountains had the lowest—22 and 23 percent, respectively.



Himalayan blackberry, a common noxious weed in western Oregon forests. Photo by Paul Dunham

<sup>6</sup> Definition by Oregon Department of Agriculture, Salem, OR. 2001.



# What Are the Results of Lichen Monitoring in Western Oregon?

THE FIA PROGRAM SAMPLES LICHENS ACROSS ALL FORESTED LAND, ALL OWNERSHIPS.

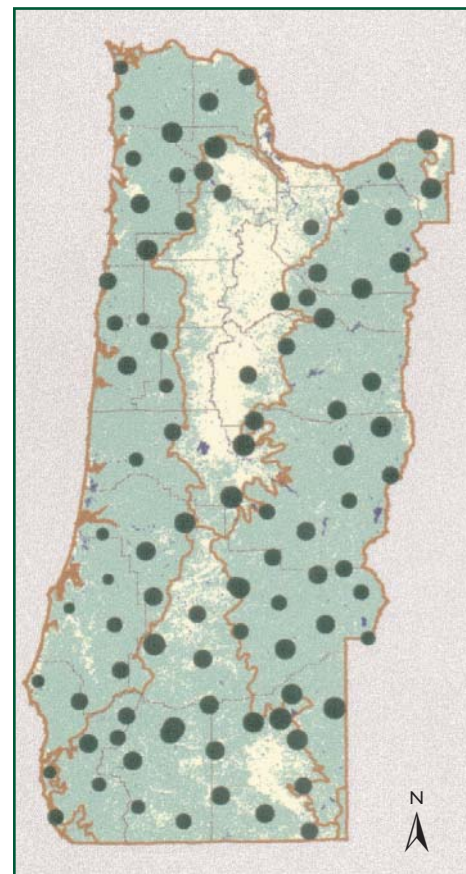
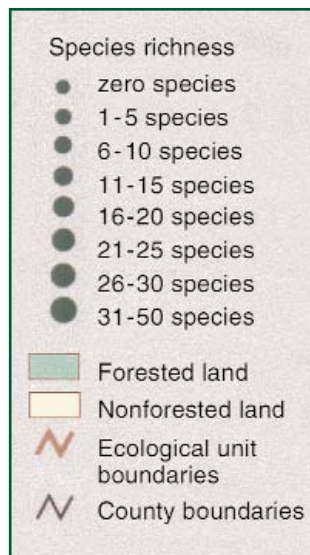
Lichen abundance and species diversity is well correlated to air pollution, especially nitrogen- and sulfur-based pollutants, and is a good indicator for potential pollution effects on other forest plant species. Lichen communities are also affected by climate (fewer species in dry climates) and forest age, structure, and density (fewer species in younger, denser, even-aged stands than in older, more open, multiage stands).

Lichen measurements since 1998 generally indicate lower species richness in areas near populated and industrial areas such as the Willamette Valley and downwind from the Portland metropolitan area. Lichen species richness is also low in some coastal and western Cascade Range areas, perhaps because of forest structure and age.



Filamentous lichen, *Usnea* spp., found throughout western Oregon.  
Photo by Don Gedney

## Species richness of lichens in western Oregon



Source: Forest Inventory and Analysis data, forest health monitoring plots, 1998-2000, USDA Forest Service, PNW Research Station, Portland, OR.

# Is Ozone Damaging Forest Vegetation in Western Oregon?

AIR POLLUTANTS, such as ozone and SO<sub>2</sub>, affect forest health. The FIA program, in cooperation with state and federal partners, monitors for ozone injury on susceptible forest plant species. Ozone not only causes visible injury to foliage but may also cause long-term growth loss and contribute to plant mortality in concert with other agents such as insects or disease. Although ozone injury is common in California forests, no visible injury has been detected in western Oregon forests since ozone injury monitoring began in 1998.

Ozone-sensitive species used for monitoring ozone injury in western Oregon:

- Ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.)
- Jeffrey pine (*Pinus jeffreyi* Grev. & Balf.)
- Scouler's willow (*Salix scouleriana* Barratt ex Hook.)
- Red alder (*Alnus rubra* Bong.)
- Pacific ninebark (*Physocarpus capitatus* (Pursh) Kuntze)
- Thinleaf huckleberry (*Vaccinium membranaceum* Dougl. ex Torr.)
- Blue elderberry (*Sambucus mexicana* K. Presl. ex DC.)
- Red elderberry (*Sambucus racemosa* L.)
- Snowberry species (*Symphoricarpos* spp. Duham.)



Ozone injury on ponderosa pine (in California).  
Photo by John Pronos

## For More Information:

### **WESTERN OREGON TIMBER STATISTICS**

**Azuma, D. [In press].** Timber resource statistics for western Oregon. Resour. Bull. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

### **WESTERN OREGON LAND-USE CHANGE**

**Azuma, D.L.; Birch, K.R.; DelZotto, P.; Herstrom, A.A.; Lettman, G.J. 1999.** Land use change on nonfederal land in western Oregon, 1973–1994. Salem, OR: Oregon Departments of Forestry, Land Conservation and Development, and Agriculture; U.S. Department of Agriculture, Forest Service. 55 p.

### **WEST COAST OZONE MONITORING**

**Campbell, S.; Smith, G.; Temple, Pat [and others]. 2000.** Monitoring for ozone injury in West Coast (Oregon, Washington, California) forests in 1998. Gen. Tech. Rep. PNW-GTR-495. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 19 p.

### **OREGON AND WASHINGTON FOREST HEALTH**

**Campbell, S.; Liegel, L., tech. coords. 1996.** Disturbance and forest health in Oregon and Washington. Gen. Tech. Rep. PNW-GTR-381. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station and Pacific Northwest Region; Oregon Department of Forestry; Washington Department of Natural Resources. 105 p.

### **PNW Forest Inventory and Analysis (FIA) Web site for general information and inventory data**

<http://www.fs.fed.us/pnw/fia/>

### **Region 6 (Oregon and Washington) Forest Insect and Disease Web site for general information and aerial survey data** <http://www.fs.fed.us/r6/nr/fid/>

### **Forest Health Monitoring/FIA Lichen Monitoring Web site** <http://www.wmrs.edu/lichen/>

### **Forest Health Monitoring/FIA Ozone Monitoring Web site** <http://199.128.173.21/spfo/fhm/ozonetrng/biozone.htm>



## Common Name/Scientific Name Tree List<sup>a</sup>

Common name	Scientific name
Bigleaf maple	<i>Acer macrophyllum</i> Pursh
Black cottonwood	<i>Populus trichocarpa</i> Torr. & Gray
California black oak	<i>Quercus kelloggii</i> Newb.
California laurel	<i>Umbellularia californica</i> (Hook. & Arn.) Nutt.
Canyon live oak	<i>Quercus chrysolepis</i> Liebm.
Douglas-fir	<i>Pseudotsuga menziesii</i> (Mirb.) Franco
Golden chinkapin	<i>Castanopsis chrysophylla</i> (Dougl.) A. DC.
Grand fir	<i>Abies grandis</i> (Dougl. ex D. Don) Lindl.
Incense cedar	<i>Calocedrus decurrens</i> (Torr.) Florin
Lodgepole pine	<i>Pinus contorta</i> Dougl. ex Loud.
Mountain hemlock	<i>Tsuga mertensiana</i> (Bong.) Carr.
Oregon ash	<i>Fraxinus latifolia</i> Benth.
Oregon white oak	<i>Quercus garryana</i> Dougl. ex Hook.
Pacific madrone	<i>Arbutus menziesii</i> Pursh
Pacific silver fir	<i>Abies amabilis</i> Dougl. ex Forbes
Ponderosa pine	<i>Pinus ponderosa</i> Dougl. ex Laws.
Port-Orford-cedar	<i>Chamaecyparis lawsoniana</i> (A. Murr.) Parl.
Red alder	<i>Alnus rubra</i> Bong.
Shore pine	<i>Pinus contorta</i> Dougl. ex Loud. var. <i>contorta</i>
Sitka spruce	<i>Picea sitchensis</i> (Bong.) Carr.
Subalpine fir	<i>Abies lasiocarpa</i> (Hook.) Nutt.
Sugar pine	<i>Pinus lambertiana</i> Dougl.
Tanoak	<i>Lithocarpus densiflorus</i> (Hook. & Arn.) Rehd.
Western hemlock	<i>Tsuga heterophylla</i> (Raf.) Sarg.
Western redcedar	<i>Thuja plicata</i> Donn ex D. Don
Western white pine	<i>Pinus monticola</i> Dougl. ex D. Don
White fir	<i>Abies concolor</i> (Gord. & Glend.) Lindl. ex Hildebr.

<sup>a</sup> For species mentioned in this publication

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The **Forest Service** of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

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